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Spatial Pricing Efficiency in Gro Markets in Tamil Nadu

by

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Abstract

The paper "Spatial Pricing Efficiency in Groundnut Markets in Tamilnadu" explores the efficiency of price information diffusion or price integration across markets. It is demonstrated that price integration across markets rather than spatial integration of markets is a prerequisite for marketing efficiency though not a sufficient condition. Further, price integration is a necessary condition for an efficient allocation of resources by the producers. And also, the concept of price integration is more amenable for testing raher than spatial integration with the available data.

In order to evaluate the pricing efficiency or price integration efficiency across markets, monthly wholesale price series data, for groundnut kernels in 10 market centres distributed across the state, for the period 1975-76 to 83-84 have been analysed.

Three measures or indices of price integration - zero order correlation co-efficients, correlation co-efficients of residuals of price series and regression analysis of residuals of price series between market centres - have been estimated and used in the analysis. As it has been demonstrated, in the paper, zero order correlation co-efficients are used to measure the degree of inter-dependency between markets in price formation. The correlation co-efficients of residuals of price series are used to ascertain if the degree of inter-dependency of markets in price formation as depicted by zero order price correlation co-

efficients is due to price information diffusion between markets or due to synchornous time and seasonal trends across markets.

Regression analysis of residuals of price series between markets is used to test if price transmission is instantaneous and efficient. It should be pointed out that, the analysis of spatial price differences or transport margin analysis leads to inconsistency between results obtained and 'a priori' expectation, given the complexities of real world trading pattern and the resultant causes of price variation across markets; the regression analysis of residuals of price series between market centres is adopted to test the efficiency of price transmission.

The various analyses carried out indicate that the markets are inter-dependent, and that the price transmission or price integration is, generally, efficient and instantaneous between markets for groundnut in Tamilnadu.

SPATIAL PRICING EFFICIENCY IN GROUNDNUT MARKETS* IN TAMILNADU

Introduction

Market integration across space is evaluated using zero order price correlation co-efficients and spatial price differences, referred to as transport margin. Several researchers have tested for spatial integration of markets on the assumption that it ensures the existence of free markets and free markets ensure pareto optimal resource allocation across space. It has been demonstrated by Newberry and Stiglitz (1984) that existence of free markets, alone, need not necessarily guarantee the existence of pareto optimal allocation of resources. Further, Harris, B (1979) argues that, spatilly integrated markets need not necessarily guarantee the existence of free markets. We do not venture into the controversy on free markets and pareto optimality and also agree that spatial integration of markets need not necessarily guarantee the existence of free markets.

Given that spatial integration does not guarantee the existence of free markets, the question that arises is why do we study spatial price relationships? Price movements, perse, in related markets merit attention as they reflect or represent the movements of equilibrium paths of demand and supply for a

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* This paper is revised version of one of the chapters of my Ph.D. thesis "Marketing of Groundnut in North and South Arcot Districts of Tamilnadu" submitted to the University of Madras, 1987.

particular produce. The degree of proximity of the price movement and the speed and accuracy of price adjustments requires to be assessed, as it helps us to understand the speed and accuracy of price information spread or the efficiency of price transmission between markets. We believe that, price transmission or information spread is a prerequisite for achieving the efficient allocation of resources across space, though not sufficient to guarantee the pareto optimal allocation of resources. Information spread, also, help the market intermediaries to identify the substitutional possibility between markets. In this regard, the statistical tools that are, normally, employed like the zero order price correlation co-efficients and absolute spatial price differences are too simple and need to be modified, as will be demonstrated in the following sections.

Adequacy and Inadequacy of Correlation Co-efficient Analysis:

For the sake of simplicity, let us assume, that there are only three markets A, B and C, of which A is a producing centre, B is a final demand market and C is an isolated market. It is assumed, further, that supply is fixed in the short run in all the three markets. To start with, let us suppose that all three markets are in equilibrium. The equilibrium prices satisfy the conditions that $P_{tB} = P_{tA} + K_A$, $P_{tB} = P_{tC} + K_C$ and $P_{tA} = P_{tC}$ where K_A and K_C are constants equal to the transportation costs between A and B and between B and C respectively. In this hypothetical situation price that prevails in C reflects its own

demand and supply condition, which is exactly synchornous with the demand and supply conditions in the other two centres. It should be observed, from this imaginary situation, that there exists no substitutional possibility and that integrating, spatially, C with A or B is not going to help achieving pricing efficiency between markets.

Let us suppose that in B, the price rises due to an upward shift in demand curve. Price rise in centre B will attract more supply from centre A as A and B are linked. Increased flow of commodity from A to B reduces the available supply in centre A, which results in increase in price that prevails at centre A. This adjustment continues till a new equilibrium is reached. The new equilibrium between A and B will satisfy the condition that $P_{t+1B} = P_{t+1A} + K_A^1$. In this new equilibrium situation K_A will be equal to K_A in the initial period, if and only if, price increase in centre B due to increase in demand is exactly transmitted to centre A. Correlation co-efficients worked out between prices in centres A and B will be equal to 1.0 as these markets are integrated. Correlation co-efficients estimated between the prices of centres; A and C and B and C, will be equal to zero indicating the existence of substitutional possibility. In this situation, as is evident, correlation co-efficients equal to 1.0 reflect spatial integration, while correlation co-efficients equal to zero indicate spatial disintegration. It appears that correlation analysis of prices between markets by different researchers are based on this simple hypothetical situation.

In order to have a complete understanding of what correlation co-efficients indicate and to make the inference from correlation co-efficient analysis meaningful, it is fruitful to consider a few other situations. Consider a second situation in which all earlier assumptions are valid, and imagine that the demand cruve in centre `C´ also shifts upward. Further, assume that new equilibrium reached in centre `C´ in this second situation exactly synchormises with the new equilibrium reached between centres A and B, and that which fulfils the equilibrium conditions listed in the first situation considered. Correlation co-efficients worked-out between prices of any two centres will be equal to 1.0. In this situation correlation co-efficients of prices between the centres A and B indicates spatial integration while that between A and C and B and C indicates association of prices.

In a third situation, instead of assuming a shift in demand for the produce, assume that transportation cost between A and B goes up. The increase in the cost of transportation leads to increase in price that prevails in centre B, while prices in the other centres remain constant. Even though markets A and B are spatilly integrated, correlation co-efficient of prices in centre A and B will be equal to zero. And also, the spatial price difference, that is transport margin, will be exactly equal to transfer cost.

In a fourth situation, instead of assuming that market C is an isolated market, assume that `C´ is, also, a final demand

centre. Now centre `C´ also derives its supply from centre `A´. Upward shift in demand in centre `B´ results in increase in price at centre `B´. This increase in price at centre `B´ attracts more supply from centre `A´, which results in reduction in supply for centres `A´ and `C´. This reduction in supply leads to increase in prices in these centres. The process of adjustment continues till new equilibria are reached, simultaneously, in all markets. The new equilibria will satisfy the conditions, $P_{t+1B} = P_{t+1A} + K_1$ and $P_{t+1C} = P_{t+1A} + K_2$, where K_1 and K_2 are transport margins equal to transportation costs between centres `A´ and `B´ and `A´ and `C´ respectively. Price correlation co-efficients worked out between prices that prevails in any two centres will equal to 1.0. Correlation co-efficients of prices between `A´ and `B´ and `B´ and `C´ are due to spatial integration and that between the prices of `C´ and `B´ are due to price transmission through common supply centre `A´.

The above examples have concentrated only on price changes in the shortrun and is restricted to few markets. To generalise these examples, suppose that there are `M´ supply centres, `N´ final demand centres and `K´ intermediary or non-final demand centres form a system of free markets. Further, assume that there exists a group of markets that are outside the system and behave independently. Under this situation, it could be that the `i´th final demand market and `j´th non-final demand market that are elements in the free market system are not directly related through trade. However, there exists a `K´th non-final demand market, in the system, which is directly related to the `i´t

final demand market. The `K'th and `j'th non-final demand markets have common source of supply viz `r'th assembly market. Now, changes in prices that occur in the `i'th final demand market are transmitted to `j'th non-final demand market, through `K' and `r'. Thus whatever happens in one market is transmitted to all other markets in the system either through direct or indirect trading connections, which help the system to reach equilibrium.

The isolated markets behave differently as changes that occur within the isolated markets do not get transmitted to other market centres. If correlation co- efficients are worked out between the prices of different markets that form the system, all the price correlation co-efficients will be equal to 1.0, while correlation co-efficients of prices worked out between market centres that form the system and the group of markets that are isolated will tend to be zero. Correlation co-efficients of prices approaching 1.0 indicate that the markets are either directly or indirectly related. Thus price transmission that takes place either through direct or indirect trading connections help markets in the system reach an equilibrium simultaneously, which seems to be an appropriate situation in the real world. Correlation co-efficients equal to zero indicate that the markets behave independently and that there exists substitutional possibility. Considering the various possibilities, it is strongly felt that correlation co-efficients can be used to identify the price transmission between the markets to infer on substitutional possibilities between the markets. However, it is

not a sufficient measure to infer interdependency between markets.

As pointed out in the first example, the equilibrium path may be synchoronous indicating that there exists no substitutional possibility, due to externalities such as synchoronous time trend in consumption and production, and seasonality in production and consumption. For this reason, it becomes essential to construct an index that adjusts for these externalities to infer on market dependence. One such index happens to be the correlation co-efficients of residuals of price series between centres, where in the trend and seasonal movements in price series in different centres are eliminated and price fluctuations peculiar to each one of the centres are correlated with each other. Thus in this paper, we use both correlation co-efficients of absolute prices and residuals of prices to infer on substitutional possibility between markets and market dependency.

So far, we have concentrated on establishing the use of correlation co-efficient to infer on substitutional possibility and on market dependence, but have not dealt with a statistic to infer on the efficiency of price adjustments. Simply put, the degree of proximity of price movement between markets is analysed through price correlation co-efficient and whether the proximity of price movement as reflected by zero order price correlation co-efficient is due to market dependency is examined through correlation co-efficients of residuals of price series between market centres. This in itself is not sufficient to establish that the market dependence results in efficient price formation

or efficient price transmission between markets. The spatial price difference at different points of time need to be carefully examined. To this end, spatial price difference analysis has been carried out by several researchers such as Cummings (1967), Gupta (1973), Uma Lele (1971) etc on the assumption that spatial price differences at different points of time will be exactly equal to transfer cost if the markets function as competitive free markets. Problems with such analysis and the modification of the analysis are dealt with in the next section.

Problems with Absolute Transport Margin Analysis and the Modifications

Analysis of transport margin or spatial price differences rests on two crucial assumptions: unidirectional flow of commodity between markets, and uniformity of the produce transacted between markets. The first assumption requires that the markets considered must be physically connected and there must be direct flow of commodities from one to the other. As discussed earlier, the markets may be directly connected or indirectly connected and the real world trading pattern is complex, and hence the first assumption, is not valid. However, one could still hold on to the expectation that spatial price differences may be either zero or equal to transfer cost depending on whether the spatial price differences worked out are between supply centres, and between supply centres and final demand or intermediary markets. Here again, it should be pointed out that, this analysis depends on the second assumption that the

produce transacted between markets are of uniform quality and that price difference arise, at a particular point of time, only due to transfer of the produce between markets. Considering the real world situation, this assumption too seems to be far from reality. In the real world price difference arises due to (1) quality differences in the produce transacted that arise due to intra and inter regional variations in agro-climatic conditions, (2) transportation cost, (3) advantage enjoyed by market centres by being located close to a final demand centre, (4) size of the markets and the resultant risk and uncertainity related to trading between them and (5) data defects. Realisation of this fact calls for modification in the analysis, so as to take care of these elements of price difference between markets. In order to substantiate the importance of this problem, tables are provided from Uma Lele (1971) and Kainth, G.S. (1973). One could see (from Table No.1) that while correlation co-efficients of weekly wholesale prices of wheat between primary markets of Punjab and final demand market Delhi are well above 0.90; for a considerable number of weeks the price differences are negative. And also, it could be seen from the same table that, where the price differences are positive, the transportation cost exceeds price differences for large number of weeks. Similarly, in Kainths' study, correlation co-efficients for wheat exceeds 0.70 while the price differences are much lower than transfer cost. These results could not be explained in terms of 'a priori' expectation, which may be because, the various components of price variation may be acting in different direction. In this

regard Uma Lele herself admits that price for comparable varieties of wheat across markets are not available. Thus, this calls for an analysis that takes care of this problem. To this end, regression analysis of residuals of price series may be an appropriate one, where in we assume that all price variations attributable to factors other than that of demand and supply flectuations in the long run tend to be additive. To put it in simple words, variations in prices due to other factors are captured in intercepts of regressions of absolute prices which get eliminated with trend. The residuals of prices after eliminating time and seasonal trend reflects only irregular variations peculiar to each one of the centre and the equation takes the form $RP_i = a_o + b_1 RP_j + V_t$ where Rpi and Rpj are residuals of price series. With these considerations, source of data and the emprical results obtained are provided in what follows.

Data

Wholesale price series data of groundnut kernels for 9 years and 10 centres have been collected for this analysis from the 'Annual Statistical Abstracts' of Tamilnadu. The markets, for the sake of convinient presentation are classified as assembly markets[2] or producing centres and final demand markets. The first group consists of market centres such as Cuddalore, Panruti, Vellore, Pollachi, Erode, Jayankondam and Salem, while the second group consists of larger cities, such as Madurai, Coimbatore and Madras. These grouping is adopted for convenient presentation of results rather than for strict classification of market centres

for analysis as most of the market centres that form the first group do not remain as assembly centres throught an year. Depending on the arrival pattern, the markets act us assembly markets in certain months and for the rest of the period act as intermediary markets. Given this observation, the analyses are carried out with respect to Cuddalore, Panruti and Vellore, which are the important assembly and intermediary markets of the two major groundnut producing districts of Tamilnadu for which data are provided in the 'Statistical Abstract' of Tamilnadu.

Correlation Analysis of Absolute Price Series:

Analysis of correlation co-efficients of absolute prices, as indicated earlier, has been carried out in relation to the three market centres viz. Cuddalore, Panruti and vellore and the results are provided in Table No.3. From the table, it could be seen that all the 24 price correlation co-efficients worked out for the period 1975-76 to 1983-84 are well above 0.90. Fifteen of the 24 correlation co-efficients are above 0.97 and 8 lie between 0.95 and 0.97, while one in less than 0.95 but exceeds 0.90. These correlation co-efficients indicate that there exists no substitutional possibility between markets. Further, they indicate that the price movement in related markets are strongly associated. However, as indicated earlier, this analysis in itself is not sufficient to infer on market dependence and hence correlation co-efficient analysis of residuals of price series have been carried out and the details are provided in the following section.

Correlation Analysis of Residuals of Price Series:

Blyn, G. (1973) and Harris, B (1979) are of the opinion, as indicated earlier, that markets need not be highly dependent as pictured by the simple correlation co-efficients. The secular and seasonal trend components present in the price series might push up the values of zero order price correlation co-efficients. Hence, the residuals of long price series after eliminating seasonal and time trends are correlated. This analysis will help us to identify if price variation due to irregular variations in demand and supply conditions in related markets are transmitted among them or not.

We assume that the price time series are additive and that cyclical components are unimportant. The assumption that cyclical components are unimportant might look odd, but given the length of the time series to be 9 years, this assumption seems to be more plausible. In order to obtain the irregular or random components of price series: The trend component has been eliminated first; by assuming a linear trend, the estimated trend prices have been deducted from the actual or observed absolute prices. Secondly, the seasonal component of the trend removed series have been calculated using twelve month moving averages and have been subtracted from the trend removed observations to obtain the irregular flectuation in prices peculiar to each one of the centres.

The residual series of prices have been used to estimate the 24 residual price correlation co-efficients, which are presented

in table . It could be observed from the table that 17 of the 24 correlation co-efficients are above 0.7, and further all the residual correlation co-efficients are significantly different from zero at 5 percent level. The results imply that markets are inter-dependent in price formation, but the degree of dependence varies between the markets considered as indicated by the absolute value of the correlation co-efficients. All residual price correlation co-efficients between the three assembly market centres and final demand centres exceed 0.75 indicating that degree of dependence is higher between these markets, while the co-efficients between assembly markets of the two districts and the assembly markets of the other districts lie between 0.53; Cuddalore-Erode, and 0.73; Cuddalore-Pollachi, indicating that, among assembly markets the degree of dependence in price formation varies considerably. However, the results do suggest that the markets are inter-dependent rather than independent in price formation.

Regression Analysis of Residuals of Price Series:

Irregular variations in the price series of each of the final demand and producing centres of other regions are regressed on the irregular variations of the price series of the three market centres of South and North Arcot districts. The slope co-efficient of each one of these regressions is tested for unity against the alternative hypothesis of not equal to unity, while the intercept in each one of these regressions is tested for zero against the alternative hypothesis of not equal to zero. This

analysis is carried out on the assumption that if the price adjustment is instantaneous, the slope co-efficient will be equal to 1.0 and if the traders take advantage of the irregular flectuations in different markets, then the intercept will not be equal to zero. Testing these null hypothesees will result in any one of the following four situations in each case (regression): (a) both the null hypothesees are not rejected (b) both the null hypothesees are rejected (c) the null hypothesis of slope co-efficient equal to unity is not rejected, while the hypothesis of intercept equal to zero is, rejected and (d) the null hypothesis of slope co-efficient equal to unity is rejected, but the hypothesis of intercept equal to zero is not rejected. The first situation implies that the price transmission is instantaneous and efficient; while in the second situation the result implies that price transmission is not efficient as (1) the price transmission is not instantaneous and (2) the irregular flectuations in the markets condsidered are taken advantage of by the traders. In the third situation, the price transmission is instantaneous, but not efficient, as the traders take advantage of the irregular flectuations in the markets considered. The results in the fourth situation indicates that the price adjustment is not instantaneous, though the traders do not take advantage of the irregular flectuations in the markets considered. Such situation might arise as a result of temporary bottlenecks in either flow of information or in the transfer of goods. Given the rationale for the analysis the results are discussed in what follows.

We have estimated 24 regressions using the residuals of price series obtained for the different centres and the results are presented in Tables 5 and 6. In 15 of the regressions both the null hypotheses; (i.e.) the slope co-efficient equal to unity and the intercept equal to zero, could not be rejected. This result indicates that the price transmission is instantaneous and efficient. In the other mine regressions the hypothesis of slope co-efficients equal to unity is rejected, while the hypothesis of intercept equal to zero could not be rejected. The results obtained in these nine regressions indicate that there are bottlenecks either in transfer of goods or information as the adjustment is not instantaneous, but the irregular flectuations in these markets are not taken advantage of by traders. This result calls for identifying the probable cause behind the observed results. Majority of the cases, where the slope co-efficient is not equal to 1.0, are in the regressions of residuals between Panruti and other centres. For this centre, we could get the weekly arrival data in the regulated market[3]; which indicates that Panruti has single peak arrival period and the peak occurs either in the months of February and March or March and April. Hence, in most part of the year, Panruti remains an importer; as either there is no arrival in the market or the arrival is insufficient to run the oil mills at Panruti. Thus this market centre imports from various other market centres depending on the arrival pattern in those markets. The size of the markets and the associated risk and uncertainty varies across these markets:- a hypothesis that could be tested subject to the availability of data for the various market centres on market

arrival, flow of commodity, transportation and communication facilities available etc,. which might cause lags in the adjustment process either because of bottlenecks in transportation or communication. Given these results, a brief concluding remarks are offered in what follows.

Conclusion:

The various analyses indicate that the price integration is efficient and instantaneous between markets, at least between majority of the markets considered. The techniques used in this paper, though simple, do offer resuelts that are much better and less controversial compared to the techniques generally adopted. The results of correlation co-efficients of residuals of price series between markets support the results of Blyn,G. (1973) as they are lower than that obtained between prices of absolute price series. However, the analysis indicate that even the residuals of price series are well correlated and thus the high value of correlation co-efficients of absolute price series between markets are not accidental. One might question, why this paper has stressed on instantaneous price adjustment rather than on short run and long run market integration as considered by Ravallion,M (1986). We firmly believe that, given the nature of time series (i.e.) monthly price series used and the production period of the crop, it is essential to concentrate on instantaneous price adjustment as is done in this paper. The production period is very short, which varies from 105 days to 120 in North and South Arcot Districts the major groundnut

producing districts of Tamilnadu; and the crop is cultivated in three seasons. Thus between the end of one crop season and beginning of the other, there is a gap of hardly a month or two. Hence price adjustment mechanism should ensure instantaneous price adjustment between related markets to help the producers to allocate their limited resources between crops efficiently. To this end, essentially this paper has concentrated on instantaneous price adjustment between markets.

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Foot Notes

1. It is assumed that length of time required for reaching a new equilibrium is one period.

2. The classification has been done for convenient reference. In the strict sense, none of the assembly markets or producing centres remains as an exporter of raw material throughout an agricultural year. The assembly market centres import Kernel from other centres during their off-peak season. Hence by producing centres, we mean those markets that act as assembly markets as well as intermediary markets.

3. More than 80% of the arrival of groundnut in South Arcot district is through regulated markets and that too in the form of Kernel.

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Table No. 1

Price Correlation Co-efficients, Cost of Transfer and Frequency Distribution of Differences between Delhi and Primary Market Wholesale Prices of Wheat (January 1955 - November 1965)

Market	Correlation Co-efficient	Cost of Transfer per Qtl		Frequency Distribution of Differences in Prices per Qtl							
				0	0-2.5	2.5-3.5	3.5-5.0	5.0-7.0	7.0-10.0	10.0-15.0	15.0 and 15.0
Moga	0.95	4.96	A	118	256	91	49	43	8	3	0
			P	21.0	45.0	16.0	8.6	7.5	1.4	0.5	0.0
Khana	0.90	4.42	A	367	131	27	24	16	3	1.0	0.0
			P	64.5	23.0	4.7	4.2	2.8	0.5	0.2	0.0
Baonala	0.94	5.02	A	51	189	101	109	75	37	7	0
			P	9.0	33.2	17.7	19.1	13.2	6.5	1.2	0.0
Kotkapura	0.95	4.75	A	98	271	89	63	35	11	2	0
			P	17.2	47.6	15.6	11.1	6.1	1.9	0.3	0.0
Jagraon	0.94	4.37	A	191	232	60	54	23	8	0	1
			P	33.6	40.8	10.5	9.5	4.0	1.4	0.0	0.2

Source: Lele, U (1971)

Notes: (1) A refers to Absolute number of weeks
(2) P refers to percentage of number of weeks to total number of weeks.

Table No.2
Correlation Co-efficient of Prices, Price Difference of Wholesale Price of Wheat and Paddy and Cost of Transfer in the Free Trade Period

Markets	Correlation co-efficient	Price Difference per qtl	Cost of Transfer per qtl
	Wheat		
Amirtasar - Delhi	0.90	1.16	6.70
" - Bombay	0.74	13.15	11.18
" - Hapur	0.90	0.92	7.22
" - Khagria	0.80	6.70	9.77
	Paddy		
Amirtasar - Delhi	0.63	0.18	6.70
" - Bombay	0.41	0.33	11.18
" - Khagria	0.74	0.40	9.77

Source: Kainth, G.S. (1973)

Table No.3

CORRELATION CO-EFFICIENTS OF ABSOLUTE PRICES BETWEEN CENTRES
(1975-76 TO 1983-84)

Centres	Madras	Coimba- tore	Madurai	Salem	Erode	Polla- chi	Jayam- kondam	Panruti	Vellore
Cuddalore	0.977	0.975	0.978	0.961	0.951	0.970	0.964	0.975	0.977
Panruti	0.976	0.969	0.971	0.959	0.948	0.959	0.962	1.000	0.974
Vellore	0.988	0.983	0.983	0.974	0.974	0.976	0.969	0.974	1.000

Note: All the co-efficients are significant at 5% level.

TABLE NO.4

CORRELATION CO-EFFICIENTS OF RESIDUALS OF PRICE SERIES BETWEEN CENTRES (1975-76 TO 1984-84)

Centres	Madras	Coimba-tore	Madurai	Salem	Erode	Pollachi	Jayam-kondam	Panruti	Vellor[illegible]
Cuddalore	0.785	0.784	0.814	0.649	0.530	0.727	0.724	0.797	0.76[illegible]
Panruti	0.828	0.745	0.763	0.663	0.562	0.627	0.724	1.000	0.7[illegible]
Vellore	0.925	0.805	0.783	0.724	0.586	0.662	0.718	0.797	1.[illegible]

Note: All the co-efficients are significant at 5% level.

TABLE NO.5

REGRESSION RESULTS OF RESIDUALS OF PRICES BETWEEN CENTRES (1975-76 TO 1983-84)

Dependent Variables (Price)	Independent Variables (Price)	Co-efficient (b)	Constant	R^2	t-values for b=1
(a) Cuddalore and Final Demand Centres					
Cuddalore	Madras	0.999 (0.081)	0.395 (3.644)	0.616	0.012
Cuddalore	Coimbatore	1.021 (0.083)	-1.131 (3.123)	0.615	0.253
Cuddalore	Madurai	0.924 (0.068)	1.218 (2.922)	0.663	1.118
(b) Panruti and Final Demand Centres					
Panruti	Madras	0.969 (0.068)	0.695 (2.594)	0.686	0.456
Panruti	Coimbatore	0.892 (0.082)	-0.748 (3.091)	0.555	1.317
Panruti	Madurai	0.796 (0.069)	1.358 (2.992)	0.582	2.957*
(c) Vellore and Final Demand Centres					
Vellore	Madras	0.950 (0.059)	0.825 (2.273)	0.856	0.847
Vellore	Coimbatore	0.913 (0.069)	-0.584 (2.602)	0.648	1.261
Vellore	Madurai	0.787 (0.062)	1.475 (2.759)	0.613	3.435*

* Significant of 5% level.

Note: Figures in paranthesees are standard errors.

TABLE NO.6

REGRESSION RESULTS OF RESIDUALS OF PRICES BETWEEN CENTRES (1975-76 TO 1983-84)

Dependent Variables (Price)	Independent Variables (Price)	Co-efficient (b)	Constant	R^2	t-value for b=1
(a) Cuddalore and Producing Centres Outside the Region					
Cuddalore	Salem	0.848 (0.102)	0.732 (3.925)	0.401	1.490
Cuddalore	Erode	0.767 (0.127)	0.442 (4.271)	0.281	1.835
Cuddalore	Pollachi	1.096 (0.107)	0.062 (3.455)	0.529	0.897
Cuddalore	Jayamkondam	0.701 (0.069)	0.669 (3.470)	0.524	4.333*
(b) Panruti and Producing Centres Outside the Region					
Panruti	Salem	0.796 (0.093)	0.952 (3.464)	0.440	2.193*
Panruti	Erode	0.747 (0.114)	0.708 (3.830)	0.315	2.219*
Panruti	Pollachi	0.868 (0.111)	0.173 (3.609)	0.393	1.189
Panruti	Jayamkondam	0.657 (0.062)	0.423 (3.122)	0.524	5.532*
(c) Vellore and Producing Centres Outside the Region					
Vellore	Salem	0.824 (0.081)	1.668 (3.441)	0.524	2.173*
Vellore	Erode	0.740 (0.105)	0.879 (4.481)	0.343	2.478*
Vellore	Pollachi	0.864 (0.101)	-0.575 (3.289)	0.438	1.345
Vellore	Jayamkondam	0.850 (0.085)	-0.846 (3.620)	0.515	1.762
(d) Cuddalore and Producing Centres of Same Region					
Cuddalore	Vellore	0.902 (0.073)	-0.461 (3.105)	0.619	1.342
Cuddalore	Panruti	0.867 (0.068)	-0.223 (0.554)	0.635	1.956
(e) Panruti and Producing Centres of Same Region					
Panruti	Vellore	0.841 (0.066)	-0.156 (2.620)	0.635	2.409*

* Significant at 5% level.

Note: Figures in parantheses are standard errors.